Comparison of Dry Needling and Inhibitory Kinesio Taping in Treatment of Myofascial Pain Syndrome of the Upper Trapezius Muscle: A Randomized Controlled Trial

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Abstract

Objective: The purpose of this study was to compare the effects of dry needling and inhibitory Kinesio taping on the pressure pain threshold and muscle thickness in women with myofascial pain syndrome in the upper trapezius muscle.
Methods: The present study was a single-blind randomized controlled clinical trial. Seventy-five women with active trigger points in the upper trapezius muscle were included and randomly divided into 3 groups of equal sizes. Groups 1 and 2 were treated in 2 sessions with a 3-day interval by dry needling and inhibitory Kinesio taping, respectively. Group 3 did not receive treatment (ie, the control group). Pressure pain threshold and muscle thickness were measured using a pressure algometer and an ultrasound device, respectively, and this was done before, 3 days after, and 10 days after the treatment.
Results: Pressure pain threshold increased significantly in groups 1 and 2 ($P < .001$) after the intervention. Muscle thickness reduced significantly in group 1 ($P = .015$) and group 2 ($P = .010$) after the intervention. No significant differences were observed between these 2 intervention groups in terms of these variables. Meanwhile, the changes in the control group in muscle thickness ($P = .430$) and pressure pain threshold ($P = .230$) were not significant.
Conclusion: Both dry needling and inhibitory Kinesio taping increased pressure pain threshold and reduced muscle thickness in participants with active trigger points in the upper trapezius muscle. These 2 therapeutic techniques appear to cause similar positive changes in pain and muscle function but may do so through different mechanisms. (J Chiropr Med 2022;21;23-31)
Key Indexing Terms: *Myofascial Pain Syndrome; Dry Needling; Athletic Tape; Ultrasonography*

Introduction

Musculoskeletal disorders are one of the main causes of pain, and one-third of patients with musculoskeletal pain have myofascial pain syndrome,[1] whose key characteristic is the development of trigger points in the skeletal muscles. These points are categorized into active and latent groups, and they can form because of psychological stresses, major injurious forces in the short-term, or minor injurious forces in the long-term.[2,3]

A trigger point is a sensitive and palpable spot in the musculoskeletal taut band that causes pain and a local twitch response (LTR) when stretched or pressed.[1,4] The pain is not merely local, and it can spread to other areas. The pattern of spreading pain is different for each muscle.[5-7] These spots can develop in any muscle, but they are more likely to develop in the postural muscles.[8] The development of trigger spots is therefore much more common in the upper trapezius muscle, where pain usually spreads to the posterior and lateral of cervical spine, the back of the ear, and temporal areas.[9]

Given the sedentary lifestyle that is common in modern society, people tend to spend much of their time in a static posture. The phasic muscles are therefore severely confined, the postural muscles gradually shorten, and muscle imbalance eventually leads to the development of trigger spots. If this pain becomes chronic and is not properly treated, it can lead to compensatory postural disorders and functional disabilities.[10,11]

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Many treatments have been proposed for myofascial pain syndrome (MFPS); 1 of the new therapeutic methods is dry needling (DN), with immediate relief of local and spreading pain as its advantages and risk of infection and invasiveness as disadvantages.[12-14] Some studies have confirmed the effectiveness of this invasive technique.[13,15] In contrast, others have found it to be ineffective and argue that it is no different from placebos.[12,16] Another new therapeutic method proposed for the treatment of MFPS is the inhibitory Kinesio taping (IKT) of the affected muscle, with simplicity and noninvasiveness being its advantages and skin allergies and long duration of each session being the disadvantages.[17,18] Similar to the previous technique, a number of studies have found this noninvasive technique to be ineffective,[19,20] whereas others have found it to be effective.[21,22] It is worth noting that both of these techniques are inexpensive, and studies that have confirmed their therapeutic effects have reported fewer therapeutic sessions for them compared with other techniques. If the therapeutic effects of these 2 techniques are similar, the patient's preferences and conditions should be considered in choosing the invasive or noninvasive method.

According to a search conducted by the author, no studies have compared the therapeutic effects of these 2 techniques on muscle thickness and pressure pain threshold (PPT). This study was therefore conducted to compare the therapeutic effects of dry needling and inhibitory Kinesio taping on PPT and muscle thickness in women with MFPS in the upper trapezius muscle.

Methods

Ethics

The present clinical trial was approved by an ethics committee (IR.SEMUMS.REC.1396.109) and registered in the Iranian Clinical Trials Registry (registration number: IRCT20151228025732N28).

Study Design and Participants

This study was conducted on a population of young adult women (age 18-35 years) with MFPS in the upper trapezius muscle and a normal body mass index (BMI) who were visited and referred by orthopedic surgeons in medical centers affiliated with Semnan University of Medical Sciences in 2018.

The study inclusion criteria were: chronic pain for at least 3 months[3]; minimum pain intensity of 30 mm based on the visual analog scale[23]; active trigger points in the upper trapezius muscle based on Simons' criteria[3] including (1) taut band in the upper trapezius muscle, (2) point sensitive to touch in the upper trapezius muscle, and (3) recognition of a spreading pattern of pain in the upper trapezius muscle after the application of pressure on the trigger points (posterior and lateral of cervical spine, temporal, supra orbital, maxillary, and mandibular areas on the affected side).[3] The study exclusion criteria were: rheumatic disorders, degenerative joint disease, myopathy, neuropathy, myelopathy, fibromyalgia, facial neuralgia, torticollis, and any form of medication over the last 2 weeks or rehabilitation program over the last 3 months targeting the trigger points.[3,24-26]

Sample Size

The sample size was determined considering PPT as the main outcome with the objective of showing the differences in each group before and after the intervention. Using the results obtained in studies conducted by Ozturk et al[22] (IKT intervention) and Lari et al[27] (DN intervention) and based on the sample size equation for t test of difference between 2 dependent means, and considering a maximum type 1 error of $\alpha = 0.01$ and a power of 0.95, the minimum sample size per group was 11 for assessing the effect of IKT and 24 for assessing the effect of DN using G*Power software (version 3.1.9.2). To adopt a conservative approach, 1 participant was added to each group, and the sample size reached 25 per group, for a total of 75 participants.

Randomization and Blinding

The study methods and objectives were explained to the participants with a simple language, and they then signed a consent form after reading it. The participants were asked not to take analgesics or muscle-relaxing medications for 1 week before and during the study.[25]

The participants were equally and randomly divided into DN (group 1), IKT (group 2), and no-intervention control (group 3) groups by way of the patients drawing a card from a series of 75 cards labeled as A, B, or C, and they were assigned accordingly to group 1, 2, or 3.

The present study had a true experimental design in which groups 1 and 2 were treated in 2 sessions, held 3 days apart, and PPT and muscle thickness were measured in all 3 groups before treatment (pretest), 3 days after the second session (posttest 1), and 10 days after the second session (posttest 2). To comply with ethical principles, each participant of the control group was treated with either DN or IKT according to their preferences after posttest 2.

The present research was a single-blind study in which randomization, assessment, and treatment were conducted by the same trained physiotherapist with 12 years of therapeutic experience.

To assess and confirm the reliability of the measurements, PPT and muscle thickness were measured in 7 participants, over 3 sessions with 1-day intervals, under fully similar conditions before the intervention.

Dry Needling Intervention

This technique was applied using a sterile acupuncture needle (Huan-Qiu, China) that was 0.3 mm in diameter and 50 mm in length.[26] First, the participants were asked to lie down in a prone position with the head in a neutral position and the arms alongside the body.

The therapist's hands were decontaminated with antimicrobial soap and water, and all surfaces of the hands and fingers were rubbed against each other vigorously for at least 15 seconds. Disposable gloves were worn immediately before and removed immediately after the DN procedure on both hands. The patient's skin was disinfected in the target area with 70% isopropyl alcohol prior to dry needling. To avoid touching the needle shaft during DN, the therapist touched the needle only at the handle. Used needles were disposed of in a regulated sharps container.[24]

After observing the principles of hygiene, the muscle was needled with a pincer palpation. The trigger point in the upper trapezius muscle was found and held between 2 fingers of the therapist's nondominant hand, and the needle was then gently inserted perpendicularly into the skin and muscle and guided toward the therapist's finger to reach the trigger point and to allow for a LTR. Pain or LTR indicated correct position of the needle. The needle was pistoned up and down 5 times, left in the same spot for 3 minutes, and then removed.[1,8,24,28]

Inhibitory Kinesio Taping Intervention

A 5-cm-wide blue I-tape (Sports Tex Kinesiology Therapeutic Tape, Korea) was used for IKT. The participant sat down and the therapist placed herself behind her. The tape was measured from the middle of the acromion process to the hairline on the nape of the neck. The base of the tape was adhered onto the acromion process in the resting position with no tension. Next, the participant's head and neck were ipsilateral rotated and contralateral lateral bent to elongate the upper trapezius muscle. The other base of the tape was anchored onto the nape of the neck at the hairline, the middle part of the tape was affixed with 15% to 25% tension parallel to the muscle fibers over the belly, and then the entire tape was rubbed onto the elongated muscle. The tape stayed in place for 3 days.[18]

Pressure Pain Threshold Measurement

PPT measurement is a technique used for quantifying the sensitivity of soft tissue that uses a pressure algometer (FG 5020; Leutron Electronic Enterprise, Taiwan) to measure the pressure causing the onset of pain at the trigger points in kilograms per centimeter.[29]

The participants were asked to lie down in a prone position with their head in a neutral position and their arms alongside their body. The examiner pressed the trigger point with the algometer tip perpendicular to the skin and recorded the pressure at the precise moment when the participant reported a sensation of pain. This measurement was repeated 3 times at 1-minute intervals, and the mean of the 3 measurements was taken as the PPT.[30]

Upper Trapezius Muscle Thickness Measurement

The morphologic measurement of the soft tissue using an ultrasound device is a valid, reliable, safe, noninvasive, and relatively inexpensive method.[31] The muscle thickness was measured using an ultrasound device (HS 2100 V; Honda Electronics, Tokyo, Japan) with a linear applicator at a frequency of 5 to 12 MHz.

The participants were asked to lie down in the prone position, with their head in a neutral position and arms alongside the body, without moving their head and neck or talking during the recording. The midpoint between the spinous process of the seventh cervical vertebra and the acromion process, which is the main site for the development of trigger points in the upper trapezius muscle, was found and the transducer was placed perpendicular to it, so that the muscle fibers were visible in parallel and lengthwise. The image was recorded at the end of exhalation. The maximum perpendicular distance between the upper and lower hyper-echogenic margins of the muscle was taken as the maximum muscle thickness. The images were recorded 3 times at 1-minute intervals. Muscle thickness was measured each time, and the mean of the 3 measurements was taken as the muscle thickness.[32,33]

Statistical Analysis

The reliability of the measurements was assessed using intraclass correlation coefficient ($ICC_{3,3}$; Model: 2 way mixed; Type: average of the 3 measurements; and Definition: consistency) and standard error of measurements (SEM). Levene statistic was used to assess the homogeneity of variances between the groups, and Shapiro-Wilke test was used to assess the normal distribution of the data, at the significance level of 0.01. After confirming these assumptions, the 1-way analysis of variance (ANOVA) was used to compare the mean values of the dependent variables between the 3 groups, and the repeated measures ANOVA was used for the intragroup comparison of the dependent variables. To compare the effect and persistency of DN and IKT on the dependent variables, the mean difference between the measurement occasions was calculated and compared among the 3 groups using the 1-way ANOVA. The pairwise comparison of the groups was completed using post hoc and Bonferroni correction tests. The statistical analysis was performed in SPSS (IBM Corp., Armonk, NY) at the significance level of 0.05 for the remaining tests.

Results

Eighty-seven participants were screened for eligibility, 12 of whom were rejected: 11 due to not meeting the inclusion criteria, and 1 for fear of the DN intervention (Fig 1).

The results of the pilot study confirmed the high level of the acceptance for reliability in measuring PPT (ICC, 0.76; 95% confidence interval [CI], 0.69-0.83; SEM, 0.2) and maximum muscle thickness (ICC, 0.98; 95% CI, 0.97-0.99; SEM, 0.36). Table 1 presents the mean and standard deviation of the underlying variables, including participants' age, height, weight, and BMI. As shown in this table, no significant differences existed between the 3 groups in terms of age ($P = .830$) and BMI ($P = .834$), but there were significant differences between them in terms of height ($P < .001$) and weight ($P = .005$).

Table 2 presents the mean and standard deviation of PPT and the upper trapezius muscle thickness in the intervention and control groups before and after treatment. As shown in this table, no significant differences were observed between the 3 groups before the intervention in terms of the mean PPT ($P = .426$), but this difference became significant after the intervention ($P < .001$). There were significant differences between the 3 groups before the intervention in terms of the mean muscle thickness ($P = .028$), but no significant differences were reported in this variable after the intervention. The intragroup comparison of the changes throughout the 3 measurement times showed significant changes in terms of PPT and muscle thickness only in the 2 intervention groups ($P < .015$), and the changes in PPT ($P = .230$) and muscle thickness (P=.430) were not significant in the control group (Fig. 2 and 3).

The post hoc pairwise comparisons showed no significant differences in the day 3 and day 10 PPT measurements between the 2 intervention groups ($P > .9$), while the differences between each intervention group and the control group were significant ($P < .001$). The post hoc pairwise comparisons further showed no significant differences between the 2 groups in the day 3 and day 10 muscle thickness measurements ($P > .05$).

Table 3 presents the mean and standard deviation of the differences in PPT and muscle thickness between the measurement sessions in the intervention and control groups. The comparison of the mean difference between the groups suggests significant differences among 3 groups in terms of the changes in PPT ($P < .001$). The post hoc pairwise comparison showed significant differences in the mean difference in term of PPT between the control group and the other 2 groups ($P \leq .001$), although the 2 intervention groups did not differ significantly from 1 another ($P > .762$). Moreover, the post hoc pairwise comparison showed no significant differences in the mean difference in term muscle thickness between the 2 groups ($P > .053$). These results confirm the immediate and persistent therapeutic effect of both interventions on PPT, with no differences between the 2 groups in this regard.

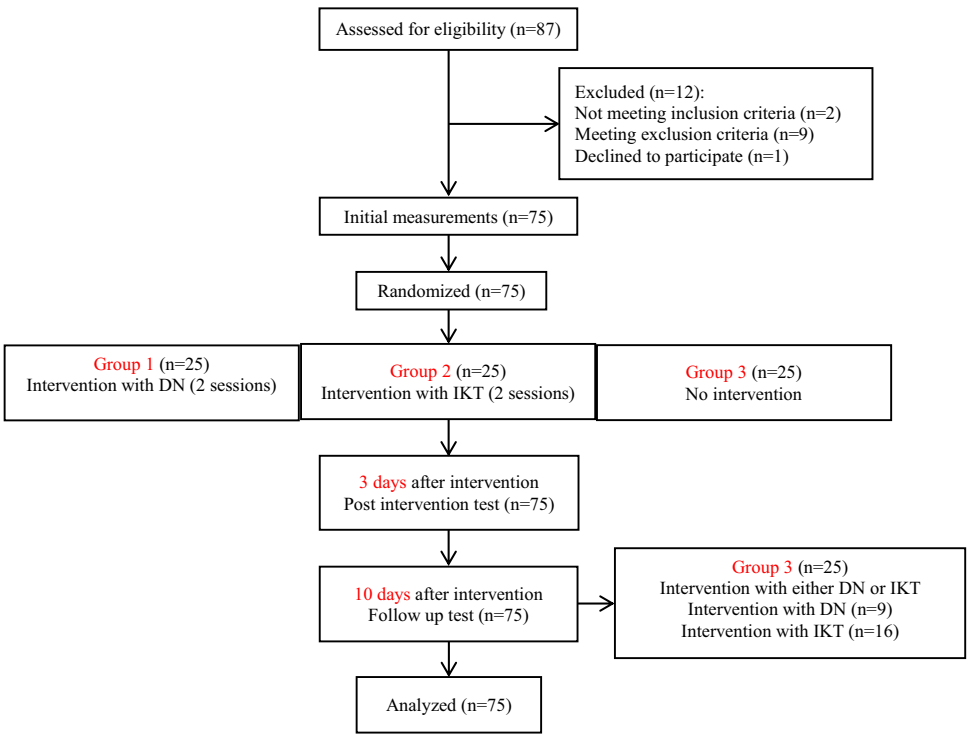

Fig 1. *Flowchart of study design and participants. DN, dry needling; IKT, inhibitory Kinesio taping.*

Table 1. *The Mean and Standard Deviation of Participant Age, Height, and Weight by Group*

Variables	Mean ± Standard Deviation			*P* Value[a]
	Group 1 (N = 25)	Group 2 (N = 25)	Group 3 (N = 25)	
Age (y)	29.4 ± 5.55	30.4 ± 5.68	29.7 ± 5.92	.830
Height (cm)	161.7 ± 7.34	166.4 ± 4.98	170.3 ± 8.21	**<.001**
Weight (kg)	61.6 ± 5.84	65.1 ± 9.82	69.2 ± 7.61	**.005**
Body mass index	23.7 ± 2.95	23.5 ± 3.22	24.0 ± 3.50	.834

Group 1: intervention with dry needling. Group 2: intervention with inhibitory Kinesio taping. Group 3: no intervention (control).
[a] One-way analysis of variance; significant at $P \leq .05$.

Table 2. *The Mean and Standard Deviation of the Pressure Pain Threshold and Upper Trapezius Muscle Thickness in the Intervention and Control Groups Before and After the Treatment.*

		Mean (Standard Deviation); Lower to Upper 95% Confidence Interval			*P* Value[a]
Variable	Group (N = 3 × 25)	Before	After 3 d	After 10 d	
Pressure pain threshold (kg/cm^2)	Group 1	13.5 (4.2); 11.8-15.2	27.5 (7.6); 24.4-30.7	30.7 (6.9); 27.8-33.5	<.001
	Group 2	12.6 (3.4); 11.1-14.0	28.1 (4.9); 26.1-30.1	31.4 (5.8); 29.0-33.9	<.001
	Group 3	13.9 (3.6); 12.4-15.4	14.3 (3.9); 12.7-15.9	14.0 (3.5); 12.5-15.4	.230
	P value[b]	.426	<.001	<.001	—
Upper trapezius thickness (mm)	Group 1	22.0 (4.3); 20.3-23.8	20.9 (3.4); 19.5-22.3	21.1 (3.6); 19.6-22.6	.015
	Group 2	22.8 (3.2); 21.4-24.1	22.1 (3.5); 20.6-23.5	21.8 (3.8); 20.2-23.4	.010
	Group 3	20.1 (3.2); 18.8-21.4	19.8 (2.8); 18.7-21.0	19.9 (2.7); 18.7-21.0	.430
	P value[b]	.028	.056	.134	—

Group 1: intervention with dry needling. Group 2: intervention with inhibitory Kinesio taping. Group 3: no intervention (control).
[a] Analysis of variance repeated measures; significant at $P \leq .05$.
[b] One-way analysis of variance**;** significant at $P \leq .05$.

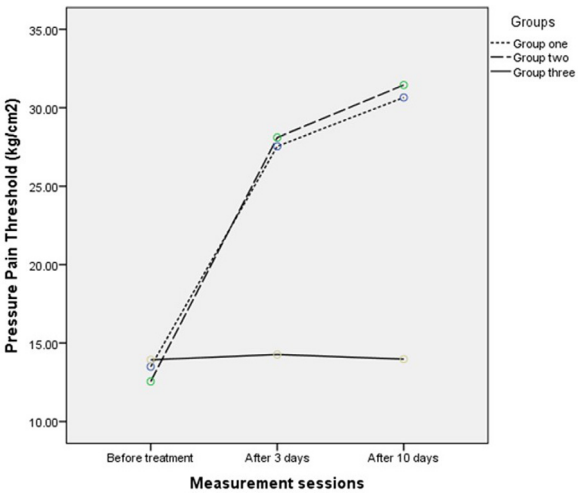

Fig 2. *Pressure pain threshold changes in group 1 (dry needling intervention), group 2 (inhibitory Kinesio taping intervention), and group 3 (no intervention) over the 3 measurement occasions (before, 3 days after, and 10 days after the intervention).*

Discussion

In the present study, PPT was significantly increased in the intervention groups after treatment. The participants were able to tolerate higher amounts of pressure on the trigger points after treatment, and no significant differences existed between the 2 intervention groups in this regard. Muscle thickness was significantly reduced in both intervention groups after treatment, and no significant differences were observed between the 2 groups in this regard, whereas the changes in muscle thickness and PPT were not significant in the control group.

Therapeutic Effect of Interventions on Pressure Pain Threshold

Rayegani et al[34] compared the effects of DN and physiotherapy on pain and PPT in participants with MFPS in the upper trapezius muscle using syringe needles instead of acupuncture needles; 1 therapeutic session was dedicated to the first case and 10 sessions were dedicated to the

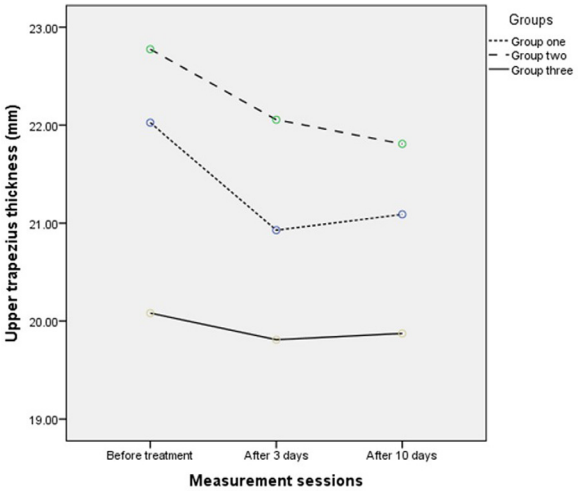

Fig 3. *The changes in the upper trapezius muscle thickness in group 1 (dry needling intervention), group 2 (inhibitory Kinesio taping intervention), and group 3 (no intervention) over the 3 measurement occasions (before, 3 days after, and 10 days after the intervention).*

second case. Both cases were shown to have the same effects in terms of relieving pain and increasing PPT.[34] Lari et al[27] compared the therapeutic effects of 3 sessions of DN and muscle energy techniques on pain and PPT in latent trigger points in the upper trapezius muscle in women with MFPS and showed that, although 2 methods together improved pain and increased PPT dramatically, no significant differences existed between the 2 techniques individually in this regard. The present findings regarding the effect of DN on PPT agree with the results of the cited studies. Hakim et al[35] investigated the therapeutic effect of LTR in 1 session of DN on the active trigger points of the upper trapezius muscle and showed that although DN alleviated pain both with and without LTR, it produced no significant changes in PPT. The disagreement between this study and previous studies as well as the present study may be due to the differences in therapeutic techniques used and the timing of the measurements, since, in the latter study, the back-and-forth movement of the needle had been more frequent and the needle had left in the tissue for a longer period of time, causing more severe inflammation and soreness in the muscle tissue. In addition, the participants were assessed 24 hours after treatment, and the tissue might not have fully recovered during this short period.

The following analgesic mechanisms have been proposed for the treatment of trigger points using the DN technique: needle insertion in the muscle tissue causes the destruction of the end plate with an impaired function, and the concentration of acetylcholine in the end plate and the associated muscle fibers' function return to their previous normal levels.[34] DN also increases blood flow and eliminates hypoxia; causes localized stretching of the shortened sarcomeres, and therefore causes local adaptation changes; stimulates the A-delta fibers for up to 72 hours after the treatment; and increases the activity of the inhibitory interneuron fibers in the posterior horn.[27]

Ozturk et al[22] showed that 2 sessions of IKT on the upper trapezius muscle in participants with MFPS increases PPT significantly, and the present findings on the therapeutic effect of IKT on PPT are consistent with the noted study. Chao et al[36] compared the therapeutic effects of 2 sessions of manual pressure release (MPR) alone and MPR plus IKT on pain and PPT in the upper trapezius muscle in participants with MFPS; they showed that the addition of IKT to the therapy regimen had no significant effects in terms of alleviating pain and improving

Table 3. *The Mean of Differences* Between the 2 Tests *and the Standard Deviation of the Pressure Pain Threshold and Upper Trapezius Muscle Thickness in the Intervention and Control Groups*

Variable	Differences	Mean (Standard Deviation); Lower to Upper 95% Confidence Interval			*P* Value[a]
		Group 1 (N = 25)	Group 2 (N = 25)	Group 3 (N = 25)	
Pressure pain threshold (kg/cm^2)	A[b]	-14.1 (6.7); −16.8 to −11.3	−15.5 (5.8); −18.0 to −13.1	−0.3 (0.8); −0.7 to 0	<.001
	B	−17.2 (6.2); −19.7 to −14.6	−18.9 (6.8); −21.7 to −16.1	0 (1.2); −0.5 to 0.4	<.001
	C	−3.1 (3.6); −4.6 to −1.6	−3.3 (4.1); −5.1 to −1.6	0.3 (1.2); −0.2 to 0.8	<.001
Upper trapezius thickness (mm)	A	1.1 (1.5); 0.5-1.7	0.7 (1.2); 0.2-1.2	0.3 (0.8); −0.1 to 0.6	.580
	B	0.9 (1.8); 0.2-1.7	1.0 (1.3); 0.4-1.5	0.2 (1.4); −0.4 to 0.8	.140
	C	−0.2 (1.5); −0.8 to 0.4	0.2 (1.3): −0.3 to 0.8	−0.1 (1.4); −0.6 to 0.5	.566

Group 1: intervention with dry needling. Group 2: intervention with inhibitory Kinesio taping. Group 3: no intervention (control).

[a] One-way analysis of variance; significant at $P \leq .05$.

[b] *A* indicates difference between pretest and posttest 1. *B* indicates difference between pretest and posttest 2. *C* indicates difference between posttest 1 and posttest 2.

PPT. MPR could have such remarkable therapeutic effects in people with MFPS that the addition of another technique, such as IKT, has caused no further differences in outcome.

The following analgesic mechanisms have been proposed for the treatment of trigger points with IKT: the reduction of pressure on the subcutaneous pain receptors leads to a reduced stimulation of the pain afferents, and the increase in sensory afferents in the soft tissue facilitates pain control or gait control mechanisms.[22]

Therapeutic Effect of Interventions on the Upper Trapezius Muscle Thickness

Koppenhaver et al[37] investigated the therapeutic effect of 1 session of DN on the infraspinatus muscle thickness in participants with MFPS and showed no significant changes in muscle thickness with this treatment. The present findings disagree with the results of this study, perhaps because of the differences in the number of therapeutic sessions, the seeking of the trigger points, and the measuring areas, since the authors noted that the measurement site was not the same as the therapy site.[37] Sarrafzadeh et al[38] compared the effects of 3 sessions of superficial versus deep DN on the upper trapezius muscle thickness in participants with MFPS and showed no significant differences between the 2 groups after treatment. Moreover, they reported a reduction in muscle thickness after DN technique, but they did not provide statistical tests to support their reporting.

It seems that mechanical stimulations in the DN technique cause structural changes in the muscle fibers, reduction in localized stiffness, fascia repair owing to the disintegration of extra connections between the collagen fibers, and tension reduction in the connective tissue.[38]

The authors' review of literature did not yield any studies of the therapeutic effects of IKT on muscle thickness in participants with MFPS or other disorders. The present study showed, for the first time, that the upper trapezius muscle thickness reduces significantly in people with MFPS as a result of IKT.[39] Kaya et al[39] showed no significant changes in the supraspinatus tendon thickness after IKT, whereas Lee and Yoo[40] in their case study showed a reduction in Achilles tendon thickness after IKT. With IKT, the mechanisms of change in the connective tissue and muscle tissue may differ; therefore, the results of the 2 noted studies cannot be compared with the present findings.

Ultrasound is an advanced medical tool that noninvasively examines muscle morphology and has previously confirmed reliability and validity.[41,42] Nonetheless, more clinical trials are required to investigate the validity of muscle thickness measurement as an indicator for prognosis or recovery.[43]

Limitations and Recommendations

Unlike the DN group, the IKT group was not carefully monitored by the therapist. Factors such as perspiration, bathing, and friction might have therefore compromised the intragroup integrity of the treatment. Because only women were included in this study, the present findings can be extended only to young women with MFPS.

In the present study, we ran 1-way ANOVA for analysis and used a *t* test for sample size calculation. According to the results of similar studies used to determine the sample size, both intervention groups (DN and IKT) showed improvement in therapeutic outcomes, whereas the placebo group showed notable deterioration. Regarding the *F* test to estimate the sample size, a very low estimation (<4 samples per group) was calculated because it was not reasonable, apparently. Therefore, we used a *t* test to compare the 2 intervention groups to obtain a more appropriate estimate of the sample size. To ensure sample adequacy for ANOVA, we redefined the power of the estimated and used a sample size for the *F* test, for which the power would be >0.999 for 25 samples in each group.

Further study is recommended with different frequencies of treatment and longer follow-up periods on other muscles in which trigger point involvement is likely. In addition, DN or IKT should also be compared with other physical and medical therapies.

Conclusion

No significant differences were observed between DN and IKT in increasing PPT and reducing muscle thickness in participants with active trigger points in the upper trapezius muscle; thus, one technique was not superior to the other. These 2 techniques appear to result in the same changes in improving pain and muscle function; however, these results may be through different mechanisms.

Funding Sources and Conflicts of Interest

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Contributorship Information

Concept development (provided idea for the research): C.T.D., Z.S.F.
Design (planned the methods to generate the results): C.T.D.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): C.T.D.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.B., C.T.D., M.M.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.B., C.T.D., M.M.
Literature search (performed the literature search): R.B., C.T.D., Z.S.F., S.B.
Writing (responsible for writing a substantive part of the manuscript): R.B., C.T.D., Z.S.F., M.M., S.B.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): R.B., C.T.D., Z.S.F., M.M., S.B.

Practical Applications

- Pressure pain threshold increased significantly in groups 1 and 2 ($P < .001$) after the intervention.
- Muscle thickness reduced significantly in group 1 ($P = .015$) and group 2 ($P = .010$) after the intervention.
- No significant differences were observed between these 2 intervention groups in terms of these variables.

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